

Challenges and Opportunities for Collectors of Recyclable Materials in the Municipality of Guajará-Mirim / Rondônia: A visualization based on the Ucinet tool

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Abstract— The research aims to describe the profile of recyclable material collectors and the possible impacts generated in the municipal landfill of Guajará-Mirim and the perception of environmental risks. From a methodological point of view, questionnaires were applied to stakeholders (pickers, small traders and the recyclable materials manager), which allowed a broader view of the recycling process and the organizational and technological level employed in this economic segment. For this, the UCINET Software and NetDraw tool was used, where it was possible to analyze the data and social networks around the recyclable materials sector in the “green city” of Guajará-Mirim, Rondônia, Brazil. Thus, allowing to consider that this activity is very fragile from a technical, technological and organizational point of view, which makes it a great threat to the sector. Furthermore, factors such as public policies, environmental awareness and cooperation seem to further undermine this important activity in the municipality, which increases the local paradox in relation to the national solid waste policy.

I. INTRODUCTION

In the context of current environmental problems, solid waste has caused concern at municipal, state and federal levels due to rampant consumption and wrong disposal, as most of it goes to open dumps. Several studies show that the population's living standards are strongly influenced by technological advances and, in order to meet the needs imposed by a consumer-oriented society, there have been numerous changes in the environment and, consequently, in human health [1]. So, with the arrival of new products on the market, society starts to acquire more modern products.

The great challenge currently is how to manage solid waste management efficiently and apply the objectives and instruments of the National Solid Waste Policy (PNRS), Law n° 12.305/2010[2]. The law instituted the National Solid Waste Policy - PNRS has as priorities the reduction of the volume of generated waste, the expansion of recycling, allied to selective collection mechanisms with social inclusion of collectors and the extinction of dumps. In addition, it provides for the implementation of sanitary landfills that will only receive waste, which cannot be reused.

Within the concept of environmental responsibility, the PNRS law establishes the bases for a practice of shared vision between the government, companies and the population, as it requires the return of products to industries after consumption and requires the government to carry out waste management plans. One of the hallmarks of this management is the social bias, with the participation of collectors who can be hired through municipal cooperatives, for collection and recycling.

For Buarque [3], achieving sustainability requires a

process of social change and increased opportunities for society, making compatible, in time and space, economic growth and efficiency, environmental conservation, quality of life and social equity, based on a clear commitment to the future and solidarity between generations.

Authors such as Cruz [4]; Veiga; Silva and Hilton [5]; Le Prestre [6]; Machado [7]; Moradilho and Oki [8]; Marques [9]; Lago [10]; Brusek [11]; Tozoni-Reis [12] highlights the importance of the 1st World Conference on Environment and Development, held in Stockholm, Sweden, in 1972 as a historic landmark for a new vision on the environment and development. At ECO-92, several proposals were approved, such as: the conversion of biodiversity, climate change, and the most important were the signatures of agenda 21, which deals with the action plan with goals for the improvement of the planet's environmental conditions. The Rio+20 conference held by the UN had as its main theme “Sustainable Development” – development that fully integrates the need to promote prosperity, well-being and protection of the environment. During the conference, several debates and discussions heated up Rio+20, so that in the end a consensus was reached and everyone signed the final document agreed by 188 countries, which sets the path for international cooperation on sustainable development.

Lago [10]; Moradilho and Oki [8] raise the question in Brazil of its natural potential, saying: “Brazil had great participations in international meetings on environmental education, even for acting within the united nations system. Since Brazil has interesting resources in the eyes of other countries, it is the target of constant attention, for its large reserves of drinking water, as well as for covering a large part of the planet's biodiversity”.

A real fact is that the topic of solid waste is currently one of the greatest environmental concerns. Societies in general are consuming more and more, and with that they advance in a way that destroys natural resources, and consumer goods, in general, have a shorter useful life, or are simply discarded for more modern ones. As a result, there is an increase in waste that is mostly disposed of in the wrong way and goes to open dumps.

In this context, the issue of solid waste also received specific treatment in Brazilian legislation. Solid waste is understood as those that are: In solid and semi-solid states, which result from activities of the community of origin industrial, domestic, hospital, commercial, agricultural, service and sweeping. This definition includes sludge from water treatment systems, those generated in pollution control equipment and installations, as well as certain liquids whose particularities make their release into the public sewage system or water bodies unfeasible, or require for this technically and economically unfeasible solutions given the best available technology [13].

The World Health Organization (WHO) defines solid waste as anything that the owner no longer wants, in a certain place and at a certain time, and that has no current or perceived commercial value. The National Solid Waste Policy Law number 12,305, of August 2, 2010, in article third, item XVI, provides: solid waste: material, substance, object or discarded property resulting from human activities in society, whose final destination is proceeded, it is proposed to proceed or is obliged to proceed, in solid or semi-solid states, as well as gases contained in containers and liquids whose particularities make its release into the public sewer system or water bodies unfeasible, or require solutions that are technically or economically unfeasible given the best available technology.

According to the National Solid Waste Policy, in a view of the Brazilian reality, the Legislation that deals with the constructive aspects of sanitary landfills is recent in Brazil. On November 11, 2008, Resolution No. 404 of the National Council for the Environment (CONAMA) was published, which provides for the environmental licensing of small-scale sanitary landfills for solid urban waste [14]. Among the federal legal instruments, it is worth mentioning the law 11,445 of January 2007, which establishes the national guidelines for basic sanitation and for the federal basic sanitation policy. According to Law 11.445/2007, in art. 2 says that users organized in cooperatives or associations can be hired as providers of basic sanitation services (which includes collection, transshipment, transport, sorting, recycling, composting, final disposal, and eventual urban public cleaning

services), provided that limited to a specific condominium or small location. Decree 5940, of October 25, 2006, institutes the separation of recyclable waste discarded by bodies and entities of the direct and indirect federal public administration, at the generating source, and its destination to associations and cooperatives of recyclable material collectors. According to information from the National Survey of Basic Sanitation carried out by the Brazilian Institute of Geography and Statistics (IBGE), only 27.7% of Brazilian cities had landfills, 22.5% had controlled landfills and 50.8% of cities dumped waste produced in dumps. In Brazil, 13% of urban waste is recycled. However, the potential for recycling is much greater. According to studies by the federal government's IPEA (Institute for Applied Economic Research), it indicates that the country loses R\$ 8 billion annually by burying recyclable materials that can return to industrial production. In addition to the economic aspects, recycling saves natural resources, such as water, in addition to providing the rational use of energy and less emission of greenhouse gases. The Federal Constitution of Brazil of 1988 consolidates the legal and institutional process in Chapter VI, which deals with the Environment, emphasizes the need for its defense and protection and seeks to establish tools for this to occur, pursuant to art. 225 of the Federal Constitution. According to the Federal Constitution of Brazil of 1988 [15] in Art. 225 – Everyone has the right to an ecologically balanced environment, a good for common use by the people and essential to a healthy quality of life, imposing on the Public Power and the community the duty to defend and preserve it for those present and future generations.

One of the economic and financial mechanisms is reverse logistics. In Brazil, about 50.8% of municipalities still use dumps as a form of disposal of urban solid waste, 22.5% use controlled landfills and only 27.7% dispose of waste in landfills. There are countless difficulties faced by 5,565 Brazilian municipalities in collecting solid waste. Only about 900 have the selective collection service. In Rondônia, productivity is low: only 12% of what is collected is recycled. This theme has been worked on at the state level and supervised by the Court of Accounts of Rondônia - TCE RO. In November 2015, the TCE RO prepared, through the General Secretariat for External Control (SGCE / DCA), a survey with municipal administrations, identifying that, of the 52 municipalities in Rondônia, 41 still use "open-air dumps", while 11 are landfill use, most in the form of a consortium. The survey also pointed out that all municipalities carry out collection services, whether they are themselves (30), outsourced (19) or in a consortium (3).

All these environmental challenges and lack of solid waste

management are evidenced in other municipalities, and this scenario can also be observed in Guajará-Mirim, State of Rondônia. Although Guajará-Mirim in 2009 received the title of “Green City” granted by the Environmental Institute of Biosphere, due to its mosaic and its extensive protected area, which makes the municipality one of the most preserved, in terms of preserved areas, the municipality does not comply with environmental principles. Guajará-Mirim is located in the western region of the state of Rondônia, on the right bank of the Mamoré River, a region where 93.7% are areas of environmental protection [16]. It has 41,656 inhabitants and an area of 24,856 km², being the second largest municipality in territorial extension and the eighth largest in population in the State of Rondônia.

According to Zanta and Ferreira [17], the open-air solid waste deposit or dump is a form of disorderly deposition without compaction or coverage of the waste, which promotes soil, air and water pollution, as well as the proliferation of vectors of waste illnesses. In turn, the controlled landfill is another form of waste disposal, with the only care being to cover the waste with a layer of soil at the end of the daily workday, with the objective of reducing the proliferation of disease vectors.

In this context, the study was guided by the problematization of solid waste management, and social and environmental externalities (garbage and poverty) in a scenario of vulnerability of solid waste collectors and the role of the public sector and the population in general. Thus, there is a need to know this activity in the solid waste segment and verify its limits and potential; perceptions and outline the profile of recyclable material collectors and their working conditions in the open-air dump in the municipality of Guajará-Mirim, western region of the State of Rondônia. Thus, when solid residues and tailings are thrown away, they also carry organic matter, which decomposes and turns into leachate. This material can contaminate both groundwater and the soil of downstream and upstream communities. Which according to Baird; Recio and Carreira [18] is constituted by volatile organic acids, heavy metals, salts of common inorganic ions and more common volatile organic compounds, being therefore very harmful to the environment and the health of the population [19]. The social impact of the garbage dump in Guajará-Mirim/RO is a place where 40 to 60 scavengers work daily and most of them arrive early in the morning and only return in the early evening. The scenario is in an area where currently several collectors make their living by selling recycled materials.

II. METHOD

The research tool used was the UCINET Software tool and NetDraw, where data from social networks are analyzed.

The tabulated data were entered into social network analysis software Ucinet and Netdraw, for quantitative analysis and visualization of the main parameters of the network [20]; [21];. The field study, of an exploratory nature, through systematic observation with on-site visit, was carried out from February to March and July to August 2019. A questionnaire was applied to solid waste collectors in the city of Guajará-Mirim / RO (scavengers who work daily at the Guajará-Mirim landfill and collectors who work in the city collecting, mainly in residential dumps); the small business collectors and the Reciclagem Paraíso warehouse manager. After carrying out the data collection, the Ucinet and Netdraw tool was applied to describe and analyze the scenarios of the production chain in the solid waste sector in Guajará-Mirim.

III. ANALYSIS AND DISCUSSION OF LIMITS AND POSSIBILITIES AT THE LOCAL LEVEL

3.1 ECONOMIC AND SOCIO-ENVIRONMENTAL SCENARIO OF THE RECYCLING ACTIVITY IN THE MUNICIPALITY OF GUAJARÁ-MIRIM

To characterize, the results are presented below using the UCINET and NetDraw tools. Alejandro and Norman [22], they claim that social network analysis is a tool that allows us to know the interactions between any class of individuals, starting from qualitative and not quantitative data. However, it is worth noting that the analysis process followed in loco in five stages: 1st At the open-air dump in Guajará-Mirim; 2º In the urban area of Guajará-Mirim with the scavengers who collect waste from residential dumps (door-to-door collection); 3rd With the manager of the Association of Solid Waste Collectors (ASCANOV); 4th Small merchants who buy these recyclable materials; 5th With the manager of the recycling warehouse Paraíso, a waste recycling company from Guajará-Mirim.

In the city of Guajará-Mirim, according to IBGE data on the disposal of solid waste, (65.18%) is collected directly by a solid waste cleaning service, (14.37%), placed in a cleaning service bucket, (17.65%) are burned on the property, (0.91%) are buried in the backyard, (1.89%) are given other destinations. On average, 10,502 kg of solid waste are collected daily, as shown in table 1.

Table 1 - Final disposal of waste in the city of Guajará-Mirim/RO.

Final Waste Destination – 2010	
Collected directly by cleaning service	6964 kg

Placed in cleaning service bucket	1535 kg	municipality of Guajará-Mirim has an association of solid waste collectors with the name Nova Vida Recyclable Product Collectors Association (ASCANOV), but without physical structure, in which it is currently abandoned. The municipality has shown capacity in collecting this material, according to information from the Reciclagem Paraíso deposit manager. 45 to 54 thousand tons are recycled per month (including plastics, cardboard, aluminum and copper). In this way, Guajará-Mirim, with the number of inhabitants, produces an average of more than 41,000 kg daily. Productivity is low, only 3.33% are recycled.
Burned (on property)	1886 kg	
Buried (on property)	97 kg	
another destination	20 kg	

Source: IBGE data. Elaboration by the authors.

3.1.1 Organizational Structure of Solid Waste Collection in the city of Guajará-Mirim/RO.

As defined by the Brazilian Association of Technical Standards (ABNT) [13], urban solid waste is solid and semi-solid waste resulting from community activities of industrial, domestic, hospital, commercial, agricultural, services and sweeping (NBR 10004/2004) [13]. The solid waste segment has been growing and gaining importance for the economic sector, where several families earn their income through the collection of this waste. The

In the city of Guajará-Mirim/RO, there are approximately 10 small businesses that buy waste directly from collectors. We can classify scavengers into two categories: those who work only in the city and others directly in the open dump. The open-air dump is 6 km from BR 425, rural area of the municipality, as shown in figure 1.



Fig.1- Photo of the dump in the city of Guajará-Mirim/RO.

Source: Google Maps [23].

The production chain of recyclable materials in the city of Guajará-Mirim is made up of three main segments: supply chain (pickers and small businesses), main chain (recycling warehouse) and auxiliary chain (transport). In the first segment are the links referring to: (1) collection and sorting - scavengers look for materials where they occur (dumps and home dumps), separate them in the way that best suits small businesses and the warehouse to sell them. Small businesses, after having a certain amount of materials, go to the recycling warehouse to sell. The

existing partnership of small businesses with the warehouse is in the provision of transport, which is provided free of charge; (2) block compaction processing - the process that prepares solid waste for transport, in the recycling warehouse using the press machine, to facilitate transport, organize and to reduce the volume.; (3) transport of recyclable materials to the city of Campo Grande/Mato Grosso do Sul. When society uses the separation of waste, it starts to play an important role in this chain as it begins to dispose of it in an orderly manner, facilitating the work

of the collector.

In Guajará-Mirim, it is possible to identify in the context of this chain a productive agglomeration in which agents involved in the collection, sorting, marketing and transport of urban solid waste participate. It is necessary for the public authorities to create public policies to strengthen this agglomeration so that a solid waste productive arrangement can be consolidated, which can work and promote the principles of economic development and social and environmental responsibility. The development and strengthening of this solid waste segment in Guajará-Mirim will allow for an increase in the productivity of the productive agents involved, in addition to the sustainability of the inclusion of collectors and environmental management, reducing environmental risks and offering minimal working conditions.

3.1.2 Labor Involved and Personnel Occupied with the activity of Collecting Recyclable Materials.

The collection of solid waste from the city of Guajará-Mirim/RO, 90% of which comes particularly from homes, and this collection is carried out by scavengers. According to information from the manager / owner of the Paraíso Reciclagem depository, it is estimated that 120 (one hundred and twenty) people work with this type of service (Personal Communication).

The materials collected in Guajará-Mirim/RO, initially, are limited mainly to household waste, to Civil Construction waste, such as aluminum, which is the second largest in quantity recycled in the municipality. In addition to the environmental impacts of solid waste, there are social impacts related to the activity of these collectors. The solid waste chain houses a large number of formal and informal workers, from employees of the Paraíso recycling company, involved in separation, processing and transport, to collectors and their families, who live exclusively from solid waste collection. Primary employment for the maintenance and support of a family, however, needs certain conditions to be met. With the creation of the Local Productive Arrangement, it will influence the positive scenario on the social issue of solid waste processing, ranging from social inclusion to the rights and benefits available to urban workers.

Currently, the sustainable vision is for there to be more environmental education in society, thereby generating a reduction in solid waste. At first, environmental education can already be worked on, so that there is awareness in the separation of solid waste into “dry” and “wet” ones, to facilitate collection by this segment. One of the lines of thought being worked on is for recycling, reuse and disposal or final destination in a way that is correct for the

environment.

3.2 ASSOCIATION OF RECYCLABLE PRODUCTS COLLECTORS NOVA VIDA (ASCANOV).

The Nova Vida association (ASCANOV) was created on July 31, 2008, and was formed by recycling collectors in the city of Guajará-Mirim/RO, located at Avenida Pentecostal, 3875, Bairro Jardim das Esmeraldas. The Nova Vida association is a legally constituted entity, and has CNPJ, Corporate Name, statute of partners and the declaration of the Federal Revenue every year, they are made. It was created with the objective of promoting the integration of the public and private sector to make viable actions, projects and partnerships that represent the micro and small businessmen who work in the segment of collection, transport and disposal of solid waste in the city of Guajará-Mirim.

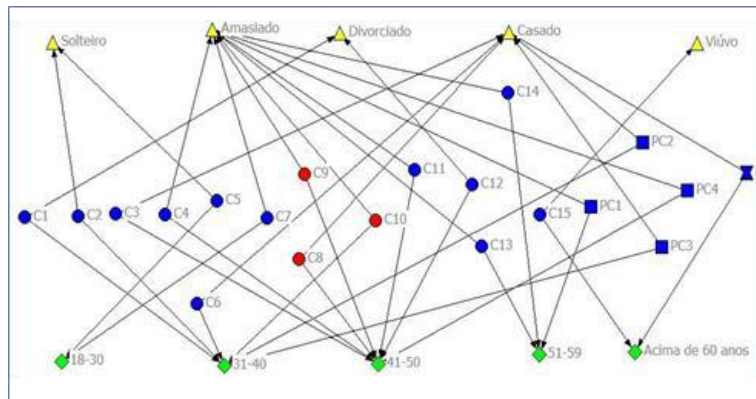
ASCANOV is currently managed by President Cibele Landivar, daughter of former President Rolando Landivar Arauz (in memoriam). According to the president, “the association has presented many difficulties, mainly because it does not have a headquarters and a shed, but that was not enough to end it. The association's board of directors is made up of 10 partners and 33 scavengers are members of the association. The monthly fee charged is R\$ 10.00 per month, which are covered to pay for the association's documentation. They have membership cards to identify that they are scavengers. However, the solid waste collection activity in the city by these collectors precedes the creation of the association of collectors.

3.2.1 Personal Data

Graph 1 deals with the population consulted regarding gender, age and marital status. The research is composed of 20 people divided into: 15 (fifteen) collectors (C) with 80% male and 20% female results, and 4 (four) micro-entrepreneurs (PC), all managed by men and in the company Paradise Recycling (D) being also administered by men. The dots in red (C8, C9 and C10) are women. Regarding the age group, it can be seen that the people who work most with recycling are in the range of 31 to 50 years old. From 18 to 30 years old (10%), 31 to 40 years old (30%), 41 to 50 years old (35%), 51 to 59 years old (15%) and over 60 years old (10%). It was observed that although most of the people consulted were over 30 years old, individual motivation, pride in the profession and there were no complaints about the activities carried out by solid waste collectors was verified.

The fifth premise was about marital status and the sample consulted resulted in 10% single, 45% have a partner, 30%

are married, 10% are divorced and 5% are widowed.



Graph 1- Gender, age and marital status.

Source: from the Research and prepared by the authors.

In relation to the premise "that deals with children", a total of 56 children was obtained: 5.36% are in the range of 0 to 5 years, 16.07% between 6 to 10 years, 11 to 18 (25%),

above aged 18 years (51.79%) and only 1.79% did not have a child.

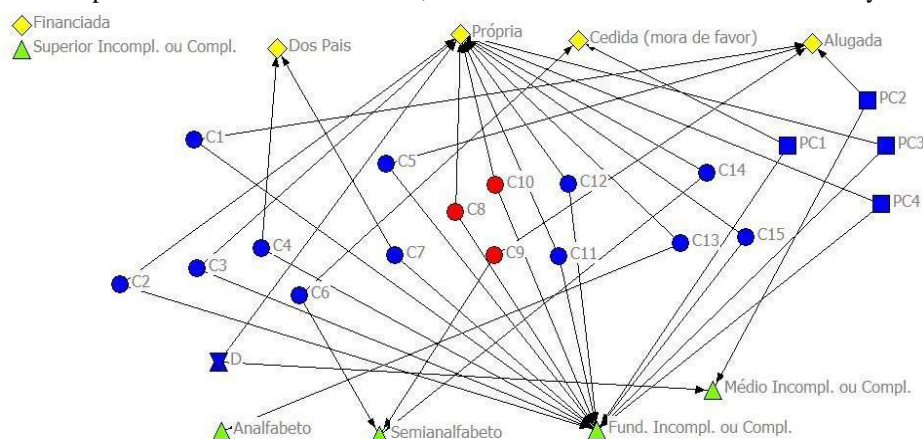
Table 2- Age range of children of actors in the solid waste sector.

	0 to 5 years	6 to 10 years	11 to 18 years old	Over 18 years old	Do not have children
C1	1	1	0	0	0
C2	0	2	1	0	0
C3	0	1	2	1	0
C4	0	1	1	1	0
C5	1	1	0	0	0
C6	0	1	2	0	0
C7	0	0	0	0	1
C8	0	0	0	3	0
C9	0	0	1	0	0
C10	1	1	2	0	0
C11	0	1	0	1	0
C12	0	0	2	2	0
C13	0	0	0	2	0
C14	0	0	0	4	0
C15	0	0	0	2	0
PC1	0	0	0	4	0
PC2	0	0	2	1	0
PC3	0	0	1	1	0
PC4	0	0	0	4	0
D	0	0	0	3	0
Total	3	9	14	29	1

Source: From the research and elaborated by the authors.

In Graph 2, it deals with the assumptions about the level of education and housing. The educational level of the respondents, for the most part, is low, (5%) illiterate, (15%) semi-literate, (70%) incomplete or complete elementary school, (10%) with incomplete or complete high school, (0%) in incomplete or complete higher education. In total, 90% are in the range between illiteracy and elementary school. Despite the low level of education,

they develop a very quick calculation ability. As for housing, (60%) have their own house, (10%) the house belongs to the parents, (20%) is rented, (10%) is given “a favor house”, and No house is financed. Even though most of them have their own residence, the predominant characteristics are wooden houses, wooden fences, bathroom “black pit”, those installed in the backyard. Only 30% have a house built of masonry.



Graph 2- Level of education and the housing situation of actors in the solid waste sector.

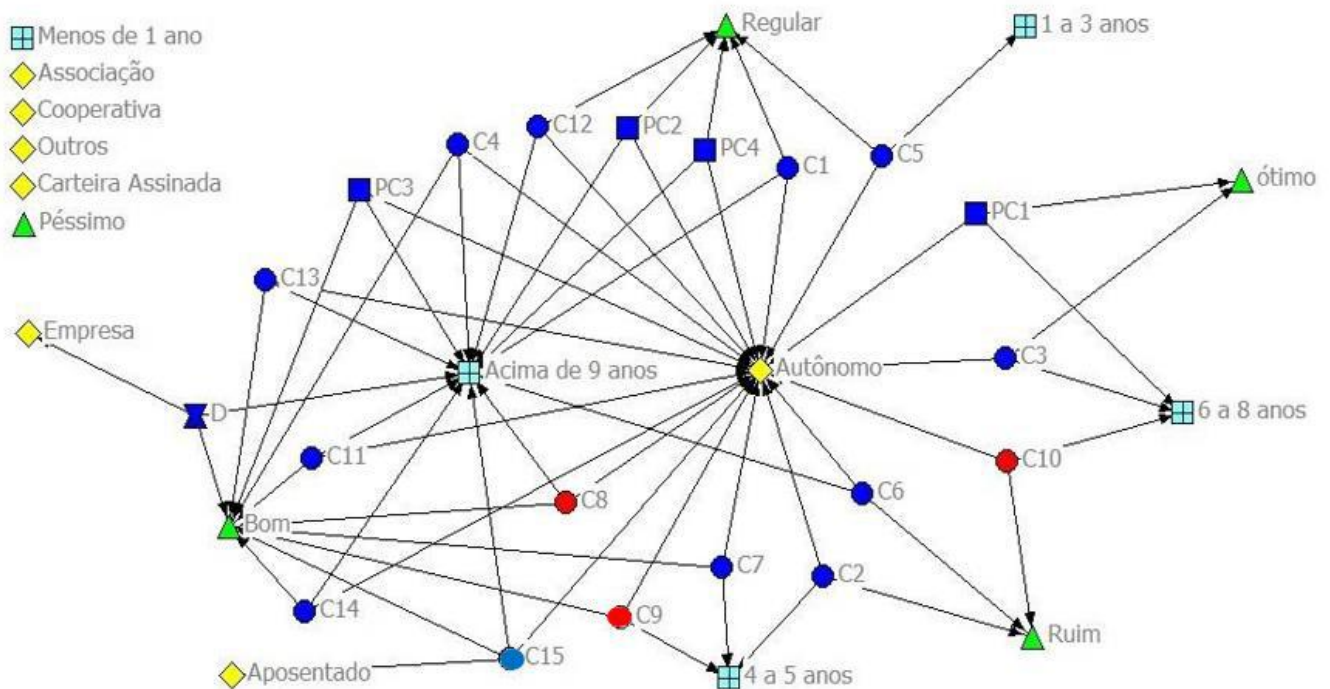
Source: from the Research and prepared by the authors.

3.2.2 Professional Data

Graph 3 covers the following assumptions: length of experience in solid waste collection, workplace and employment relationship and reason for working in this activity in the solid waste sector. On the premise “How long have you been involved in collecting these recyclable materials?”. It is observed that 80% of the actors have been involved in solid waste collection activity for over 5 years. None of them are less than 1 year old, 1 to 3 years old (5%), 4 to 5 years old (15%).

Next, it will deal with the place and forms of work, resulting in: (0%) have a relationship with the association

of collectors, cooperatives and/or others, (95%) are self-employed, and of these, 5% are retired. As for the link with a company, only 5% are linked to this activity. The concept of self-employed was used as a person who works in the informal market with sporadic or daily work and without an employment relationship. Still in Graph 3, it dealt with “Relationships in the work environment”. The result was: 0% very bad, 15% of them answered “bad”, while 25% said “fair”, with 50% saying “good” and only 10% excellent.



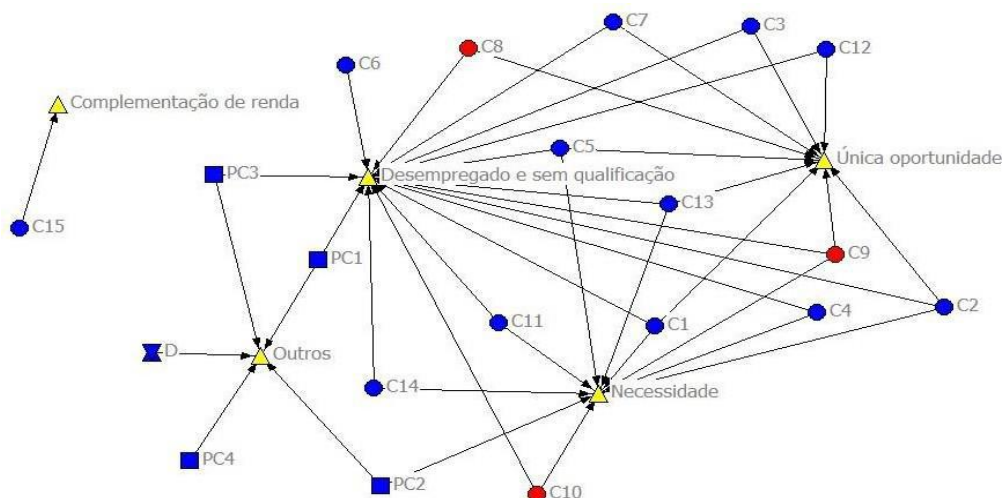
Graph 3- Employment bonds, length of experience and relationships in the work environment in the solid waste sector.

Source: from the Research and prepared by the authors.

3.3 ECONOMIC DATA AND THE ENVIRONMENTAL PERCEPTION OF THE ACTIVITY DEVELOPED

Regarding the main reason that led to working in the collection of recyclable materials, they answered more than one reason why they chose the activity: 80% said it was because they were unemployed and unqualified, at the same time 50% said it was out of necessity, and 45% said it would be their only opportunity, 5% as a supplement to their income and 25% for other reasons.

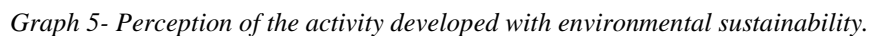
The definition of others was specified as a way, according to them, as a way to earn money without leaving home. However, the situation that draws the most attention is the fact that these workers do not have a job guarantee, as they work in the informal market, being able to carry out daily activities that spread diseases, as well as being exposed to the sun and rain. The excess of hours worked and being overweight are part of the daily life of these workers. (Graph 4).



Graph 4 – Main reason for working in solid waste collection.

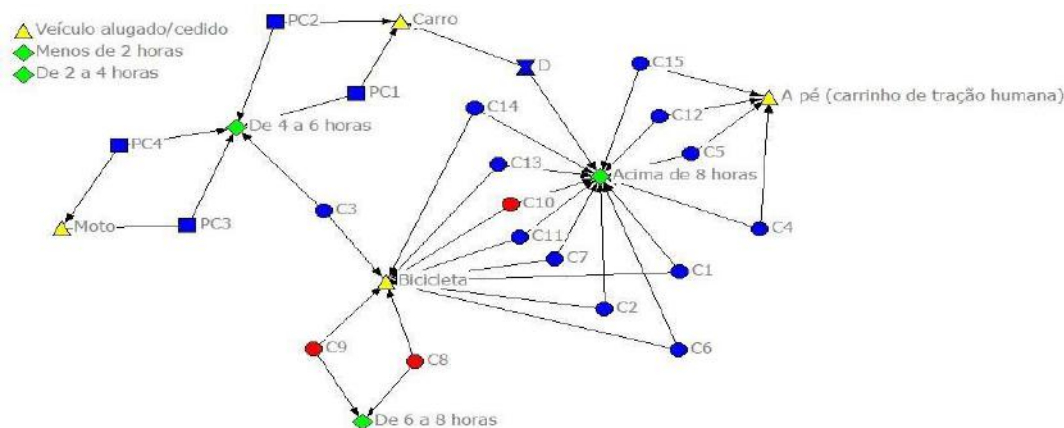
Source: from the Research and prepared by the authors.

"regular", 75% "good" and 20% "great", that the positive impact is satisfactory. Reuse of materials: 0% "very bad", 0% "bad", 30% "regular", 60% "good" and 10% "excellent". Despite seeing it as a positive, they do not have a work developed for the reuse of materials. Decrease in Visual Pollution: 0% "terrible", 0% "bad", 15% "regular", 70% "good" and 15% "excellent". Decrease in the volume taken to landfills: 0% "terrible", 0% "bad", 5% "regular", 80% "good" and 15% "excellent". It can be observed that the perception of environmental sustainability is seen as positive for most of them, as shown in (Graph 5).



In this premise, he dealt with "What is the means used to collect recyclable materials": 55% of them use the "bicycle" as transport for collecting solid waste, 10% "motorcycle or scooter", 15% "car" and 20% collect on foot (human-powered cart). Starting from the premise, it

was asked “How many hours are worked per day? The result barely varied, prevailing 65% above “8 hours/daily”, 10% of “6 to 8 hours/daily”, 25% of “4 to 6 hours/daily” and 0% less than “two hours daily ” and from “2 to 4 hours”. (Graph 6).

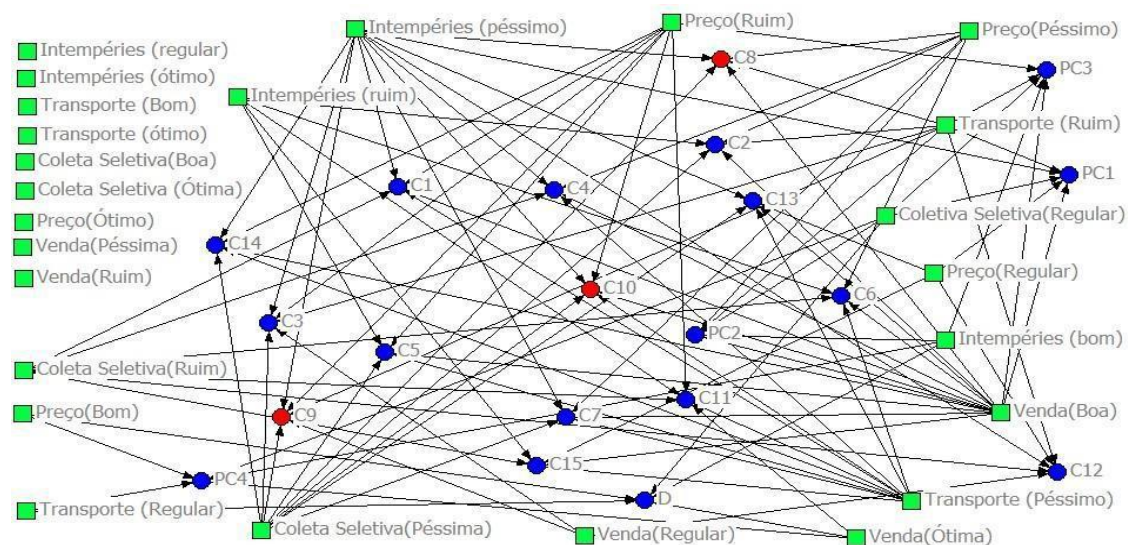


Graph 6- Hours worked per day.

Source: from the Research and prepared by the authors.

The main difficulties faced daily in the activity are presented in the form of the following assumptions: I- Weather, II- Transport (daily loading), III- Selective Collection in the City, IV-Price and V- Sale. It is worth noting that this activity is carried out daily and with hours worked in excess. One of the ways to facilitate the work of these waste pickers would be if there were selective collection and environmental education on the part of the population. As for the options: I- bad weather: 55% “terrible”, 25% “very

bad”, 0% regular, 20% “good” and 0% “excellent”. II- Transport (daily load): 45% “terrible”, 40% “very bad”, 10% regular, 5% “good” and 0% “great”. III-Selective Collection in the City: 45% “terrible”, 30% “bad”, 25% regular, 0% “good” and 0% “excellent”. IV-Price: 30% “terrible”, 40% “very bad”, 20% reasonable, 10% “good” and 0% “great”. V- Sale: 0% “very bad”, 0% “very bad”, 15% fair, 70% “good” and 15% “excellent” (Graph 7).

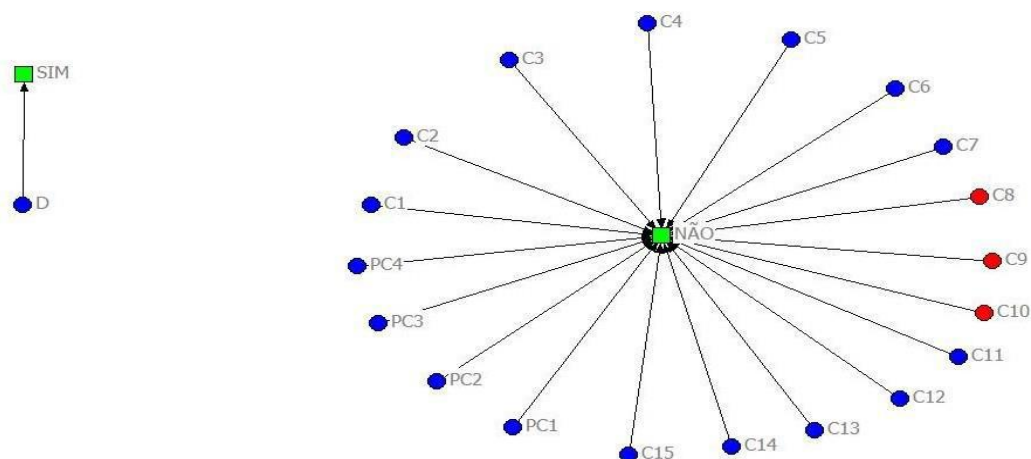


Graph 7- The main difficulties faced daily by solid waste collectors.

Source: from the Research and prepared by the authors.

The use of personal protective equipment is almost absent: 95% said they do not use any personal protective equipment such as (gloves, masks, etc.), and only 5% use these. The only one who makes use of this equipment is the owner of the recycling warehouse with boots and

gloves. It is a scenario that should be criticized and that deserves attention, as we can observe that, in addition to their daily dangers, at any time these workers can cut themselves with objects, in addition to the odor of slurry present in open dumps, as shown in (Graph 8).



Graph 8- Use of personal protective equipment.

Source: from the Research and prepared by the authors.

Every day, around 90 people go out to collect recyclable materials, men and women who use human-powered cars to carry out this work. It can be seen that no personal protective equipment is used by the worker (gloves, boots, mask, etc.). Regarding the main materials collected, the monthly average is around 40,000 kg, including: plastics (18,000 kg), aluminum (10,000 kg), cardboard (5,000 kg), copper (1,000 kg) and others (6,000 kg). The price list that the recycling deposit pays per kg corresponds to R\$ 0.50 plastic, R\$ 0.10 cardboard, R\$ 2.00 aluminum and R\$ 8.00 copper. Small businesses buy 20% to 30% cheaper than the recycling depot. (Table 3).

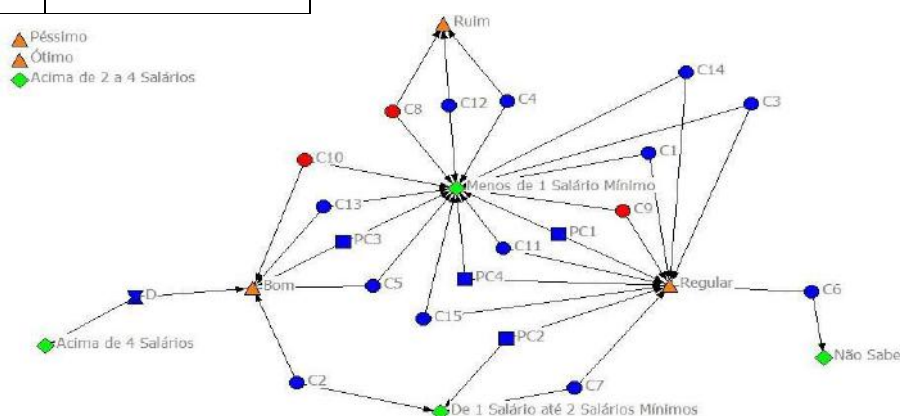
Table 3- Main materials collected/kg.

Material	Quantity/kg
Plastic	18.000kg
Aluminum	10.000kg
Cardboard	5.000kg

Copper	1.000kg
Others	6.000kg

Source: From the research and elaborated by the authors.

On this premise regarding the "monthly billing of recyclable materials": 75% receive less than 1 minimum wage, 15% from 1 to 2 minimum wages, 5% above 4 minimum wages and 5% don't know. The warehouse manager's revenue is around R\$ 25,000 to R\$ 30,000 reais (gross), deducting costs and expenses, net sales are between R\$ 4,000.00 and R\$ 5,000.00 (Graph 9). As for the premise that deals with "It considers the financial return to be sufficient to support or supplement the family income": (0%) terrible, 15% bad, 55% fair, 30% good and 0% said great. Despite the low profitability, most consider the support Regular (Graph 9).



Graph 9- Monthly billing in the collection of recyclable materials.

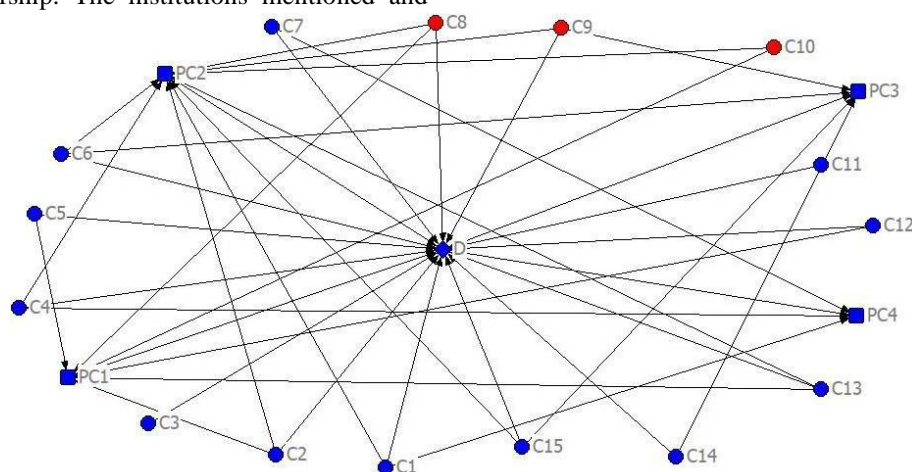
Source: from the Research and prepared by the authors.

The company Reciclagem Paraíso, located in the city of Guajará-Mirim, was founded ten years ago. It currently has a staff of 6 employees plus two managers. The cost of transporting recyclable materials is outsourced, and the company that collects recyclable materials does it 3 times a month, on average from 15 to 18 tons, and the value of each ton is R\$ 280.00. Freight is around R\$ 4,200.00 to R\$ 5,040.00 to the city of Campo Grande, Mato Grosso do Sul. The transport of recyclable material per month is around 45 to 54 tons. After purchase, the residues are separated and then pressed into blocks for transport to the city of Campo Grande, State of Mato Grosso do Sul. In the last five years, 1,500 (one thousand five hundred) tons were transported (Personal Communication).

When dealing with the premise “which partnerships exist with public and private institutions, recycling collectors and small recyclable material traders”, they informed that there is no partnership. The institutions mentioned and

remembered were: SEBRAE, SENAI, FIERO, Commercial Association of Guajará-Mirim, Universities and Research Centers, City Hall and City Council of Guajará-Mirim, schools, NGOs, Depósito Paulo Zeed (company responsible for collecting household waste), Association or Cooperative of Collectors, the Government of the State of Rondônia, State and Federal Deputies, or society in general.

The only existing partnership is between buyer versus collector. The warehouse manager goes to the small points of businesses that buy recycling, offering them free transport to the Paraíso recycling company. The commercial relationship takes place between collectors, small traders and the recycling warehouse manager, as shown in Graph 10. Every 15 days, the Paraíso recycling company also collects it directly from the dump, as agreed between the manager and the collectors.



Graph 10- Commercial relationship of collectors x small traders x manager of the Recycling deposit.

Source: from the Research and prepared by the authors.

3.4 CHALLENGES AND OPPORTUNITIES FOR COLLECTORS

The importance and potential of the solid waste segment in the city of Guajará-Mirim/RO is currently not organized. Several stakeholders could take part, such as: institutions from the productive, public, research and third sector. In a broader sense, these partners are part of a group of agents that have the capacity to strengthen and influence the behavior of local society and public and private institutions, aiming to consolidate environmental education for selective collection and economic sustainability for these collectors of solid waste.

At first, the proposal is to reactivate the headquarters of the ASCANOV association and build a shed to store the collected materials. With this it is possible to offer training, professional qualification, social inclusion and

environmental education for environmental preservation.

3.4.1. Potential partnerships for the Solid Waste sector.

In the Productive Sector: Association of Solid Waste Collectors in the municipality of Guajará-Mirim/RO - ASCANOV; headquarters for training courses, meetings and storage of collected materials: Promote the generation of work and income through solid waste. Brazilian Micro and Small Business Support Service/ Sebrae-RO: Promote training courses for solid waste collectors with themes focused on strategic planning. National Service for Industrial Learning/Senai-RO: Offer courses and learning programs in different modalities for solid waste collectors.

In the Public Sector (Federal, State and Municipal): Ministry of Labor and Employment: Provide information on how to formalize solid waste collection activities through labor contributions. State Public Ministry:

Promote the inspection of solid waste disposal by the private company Depósito Paulo Zeed (DPZ), which is contracted to provide this service by the Municipality of Guajará-Mirim/RO. Municipal Health Department: Promote lectures on the conditions exposed by the activities developed, and influence the use of PPE (personal protection equipment). Municipal Secretariat for the Environment (SEMMA): Seek partnerships to create collection points in public and private institutions. Federal University of Rondônia (UNIR) and Federal Institute of Rondônia (IFRO): Integrate the Guajaramirenses community, in a sustainable manner, with actors in the productive sector (solid waste collectors) and promote and support projects for this sector. Seek tools to ensure that goals are met and consolidate and strengthen your learning system, boosting its development and expansion.

3.4.2 Impact Mitigation Proposals

In order to propose measures to reduce the impacts on the open-air dump in Guajará-Mirim, some mitigating measures are mentioned, such as: For the soil, the best option would be the removal and transport of the mass of waste from the dump to a landfill, and the use of grasses to retain rainwater, reducing the speed of its surface runoff. For air quality, it would be necessary to direct the waste to the landfill and monitor the area to avoid burning the waste, and possible fire risks, due to the presence of biogas, in addition to encouraging environmental education practices. For a material from household waste to reach the recycling industry, there must be a collection and sorting system that guarantees that the material is recovered, meeting the quality and quantity criteria of the recycling processes. This sorting system, along the treatment chain, begins with the activity of consumers (separation at source), extending to other processes, such as the sorting that may take place in the association of ASCANOV collectors.

3.4.3 Recycling Proposals as Social Inclusion

The law on the National Solid Waste Policy reinforces the social bias of recycling with the participation of collectors, organized in associations and cooperatives. The partnership is the tool to be explored with this low-income workforce, which with this law, can be hired by municipalities without public bidding, becoming a priority criterion for accessing federal resources. The great challenge for Guajará-Mirim/RO is to mobilize the collectors, train and equip the association to play its important role. Four general strategies can be indicated so that recycling and the collector assume a more relevant space in the solid waste management system, considering that the expansion of the collector's role in the recycling

production chain will greatly contribute to the efficiency of the entire system. The first strategy is to include them as selective collection service providers through the municipality of Guajará-Mirim, this inclusion will improve the productivity of sorting, increasing the quality of recyclable materials that reach the collectors. With that, it increases the quantity and improves the quality of the raw material to be recycled. A second strategy is to invest in equipping the association of collectors, but the economic viability of such investments, as well as access to resources, are a challenge. Thus, there will be capacity for the association to be contracted by the municipality for collection and recycling. The third strategy is the efficiency of collection and sorting, which can be enhanced with the participation of society, through the separation of solid waste, and with that these reach the association, increasing the quantity and quality of recycled raw material. Finally, the fourth strategy would be to add value to the materials separated by the pickers, the objective would be to increase the pickers' income.

Workers can be trained and qualified to expand production and economic increase. There are several challenges on the subject of solid waste, as it requires large investments, which requires creative solutions to not generate more waste of raw materials. The inclusion of collectors in the GIRSU (Integrated Management of Urban Solid Waste) system points out important strategies to deal with the external effects, the result of the production and consumption dynamics of the modern world, and in a contradictory way, at the same time, united through the inequality and the misery of the population.

IV. FINAL CONSIDERATIONS AND RECOMMENDATIONS

This work sought to establish preliminary comments on the environmental problems caused by the disposal of solid waste and to describe the impacts caused to the environment and society that can contract various diseases through the contamination of the water table by leachate.

Given this reality, this research verifies the need to build a landfill for final disposal of solid waste and to be implemented by the Municipality of Guajará-Mirim in the State of Rondônia. An efficient way to alleviate the problem is the construction of a landfill whose impacts on the environment with its implementation are small and easy to control, compared to the benefits it is able to provide to municipalities that invest in this type of system. Landfill is an attractive and lower-cost method for communities with few financial and human resources, and which can satisfy the conditions for preserving the environment.

Currently, collectors in Guajará-Mirim/RO are inserted in an informal collection scenario and in the selection of recyclable materials. This condition demonstrates its unfavorable position in the link of the production chain, with the lowest economic revenue. The collectors' recyclable material collection system has three main limitations: 1) low remuneration; 2) lack of technology and 3) lack of public awareness of selective collection.

There is a need for continuous monitoring of the soil, surface and subsurface water of the aforementioned dump in Guajará-Mirim/RO, as it is a potential source of contamination. There is a need to analyze the water of the streams, especially those close to the dump. It was not possible to carry out the physical, chemical and biological analysis and the lack of it did not allow us to establish a precise link regarding the quality of soil and water.

Thus, it is essential to consider carrying out inspections under the legal aspect of the matter, but for that an investigation is necessary that offers an answer to the whole society and that the Public Power can comply with the legislation of the National Policy on Solid Waste. It is hoped that this work can contribute to local public policies and as a source of research for other works.

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